



Inadvertent PCBs in Consumer Products

Xiaoyu Liu, Ph. D.

U.S. EPA Office of Research and Development
National Risk Management Research Laboratory

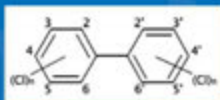
Michelle Mullin

U.S. EPA Region 10
Office of Air and Waste

SRRTTF Meeting, Spokane, WA
August 27, 2019

Introduction

Polychlorinated biphenyls (PCBs)



- n=1-5, 209 congeners
- Widely used during the 1950s -1970s, banned the manufacture in 1979
- Inadvertent PCBs
 - ❖ Generated during chemical production processes and contaminate products and waste streams
 - ❖ Production of diarylide yellow pigment, and titanium dioxide
 - ❖ Concentrations in consumer products as high as ppm level



Research Objective

- Characterize potential sources of PCBs in consumer products

Products Tested



Modeling Dough



Art Paint



Finger Paint



Crayons



Sidewalk
Chalk



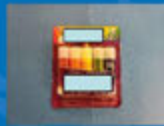
Wafers Box



Art Chalk



Chalk Paint



Glue Sticks



Foam Sheet



Glitter Foam Sheet



Sidewalk Paint
Powder



Cereal Box



Cereal Box



Protein Bar Box



Cereal Bag

Source Characterization

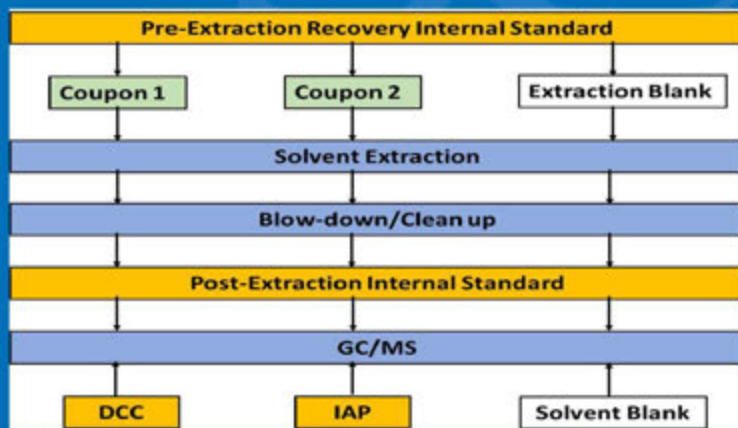
➤ Extraction Methods

- ❖ Sonication vs. soxhlet extraction
- ❖ Hexane vs. methylene chloride (MeCl_2)
- ❖ Extraction recovery check

➤ Analytical Method

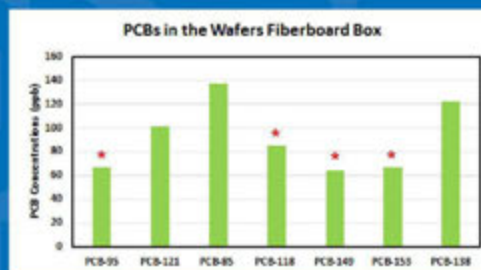
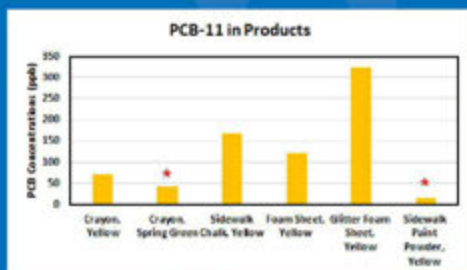
- ❖ Agilent GC/MS
- ❖ 5 sets of calibration mixtures covering all 209 congeners
- ❖ Analytical recovery, method precision and instrument detection limit

Sample Extraction Process



Results

Concentrations (Average of duplicates)



* Concentration below the lowest calibration but above the instrument detection limit

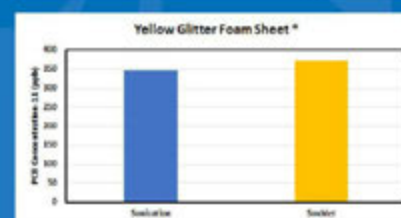
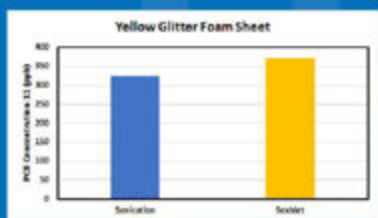
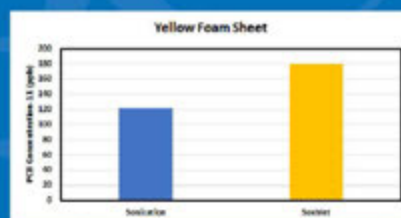
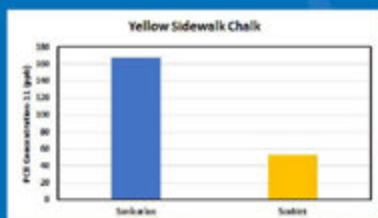
Results

Soxhlet vs. Sonication

	Sonication-Hexane	Sonication-MeCl ₂	Manual Soxhlet
Solvent Volume	10 mL	10 mL	175 mL(MeCl ₂)*
Extraction Duration	30 min	30 min	18 hours
Sample Preparation	1 hour	1 hour	20 hours

* 150-300 mL depending on the size of the soxhlet and boiling flask

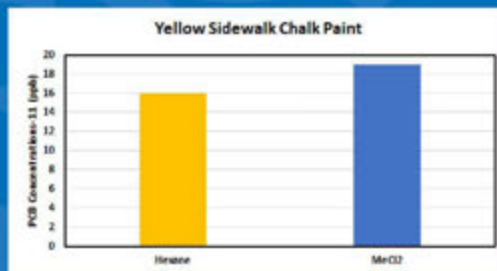
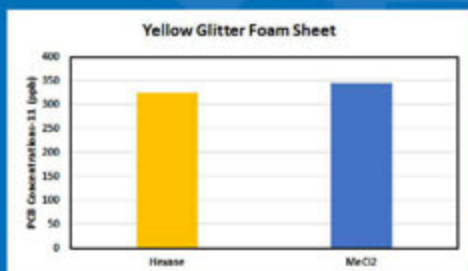
Soxhlet-MeCl₂ vs. Sonication-Hexane



* Used sonication-MeCl₂ method

Results

Sonication (Hexane vs. MeCl₂)



Conclusions

- 7 out of 16 products detected PCBs with the concentrations from below lowest calibration concentration to 325 ppb
- 6 out of 7 products detected PCB-11 only
- 1 out of 7 products detected PCB-95, PCB-121, PCB-85, PCB118, PCB-149, PCB-153 and PCB-138
- Sonication-MeCl₂ extraction method is better in practice
- Provided information to the product purchasing efforts
- Will inform the underlying questions regarding whether or not exposure pathways exist from these products

Exploratory Considerations

- Test more consumer products
- Investigate emissions of PCBs from consumer products to indoor air
- Investigate migration of PCBs from consumer products to dust
- Improve source emission models for exposure assessment

Disclaimer

This presentation has been reviewed in accordance with U.S. EPA policy and approved for presentation. The views expressed are those of the author and do not necessarily represent the views and policies of the agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Acknowledgement

We thank Dr. Kathleen Compton from EPA Region 10 and Kathleen Woodward from EPA Region 1 for discussing the project and reviewing the abstract of this presentation, and Mr. Gary Folk from Jacobs Technology Inc. for preparing and analyzing the samples.

Thank You !



Images from the U.S. EPA Facility in Research Triangle Park, NC